

WYOMING MOUNTAIN LION MORTALITY REPORT

HARVEST YEARS: 2010-2012

September 1, 2010 – April 15, 2013



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Cover Photo: Biopsy sampling work to monitor mountain lion populations in the Bear Lodge Mountains of Northeast Wyoming. *Luke Ellsbury*

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INTRODUCTION

The following report contains a synthesis of material related to mountain lion management for Wyoming from 1 September 2010 (Harvest Year 2010) through 15 April 2013 (Harvest Year 2012). The results presented represent an analysis of the current 3-year cycle of mountain lion management, and represent the second 3-year management cycle for mountain lions in Wyoming since Commission approval of the Wyoming Game and Fish Department (WGFD) Mountain Lion Management Plan in 2006. Data will be presented by hunt area and Mountain Lion Management Units (MLMUs) annually and combined over the 3-year period to assess trend of mountain lion population status in order to evaluate the efficacy of management strategies and how these relate to mountain lion mortality, population status and viability, as well as evaluating how harvest management strategies relate to other issues pertaining to mountain lion ecology and management in Wyoming.

Mortality data on mountain lions were gathered annually from among 32 hunt areas (Figure 1) grouped into 5 MLMUs. The boundaries of MLMUs encompassed large areas with contiguous habitat and topographic features indicative of high quality mountain lion habitat. Each hunt area had a maximum annual mortality limit that varied from 2-25 animals, with 3 areas having unlimited mortality limits. If a mortality limit was reached, the hunt area automatically closed; otherwise hunt area closure occurred at the end of the harvest season. During mandatory inspections of harvested animals, many variables were recorded including: harvest date, location, sex, lactation status, estimated age, number of days spent hunting, use of dogs, other lions observed, as well as several other parameters. Skulls and pelts were presented in unfrozen condition so teeth could be removed and to provide evidence of sex and lactation status. Lactation status was used to determine age class for female mountain lions. The information gathered during inspection was used to assess sex/age structure of harvested animals. In addition to harvest data all known mortalities were documented and quantified in order to better assess trends related to mountain lion mortality and determine a total impact related to human-caused mortality of mountain lions throughout Wyoming.

The Wyoming Mountain Lion Management Plan (WGFD 2006) supports an adaptive management process, enabling Department personnel the ability to evaluate management changes as they occur by sustaining mountain lion populations in core habitat at varying densities depending on management objectives across the State. For more in-depth explanation of data analysis techniques, harvest criteria, and discussions on statewide mountain lion management, peruse either the Mountain Lion Management Plan (WGFD 2006) or the Wyoming Mountain Lion Harvest/Mortality Report: Harvest Years (2007-2009 (Thompson et al. 2010), both available from the Large Carnivore Section or through the WGFD Website: <http://wgfd.wyo.gov>

WGFD does not estimate mountain lion numbers to manage populations. Rather, population trends are assessed through sex and age composition of mortality data (Anderson and

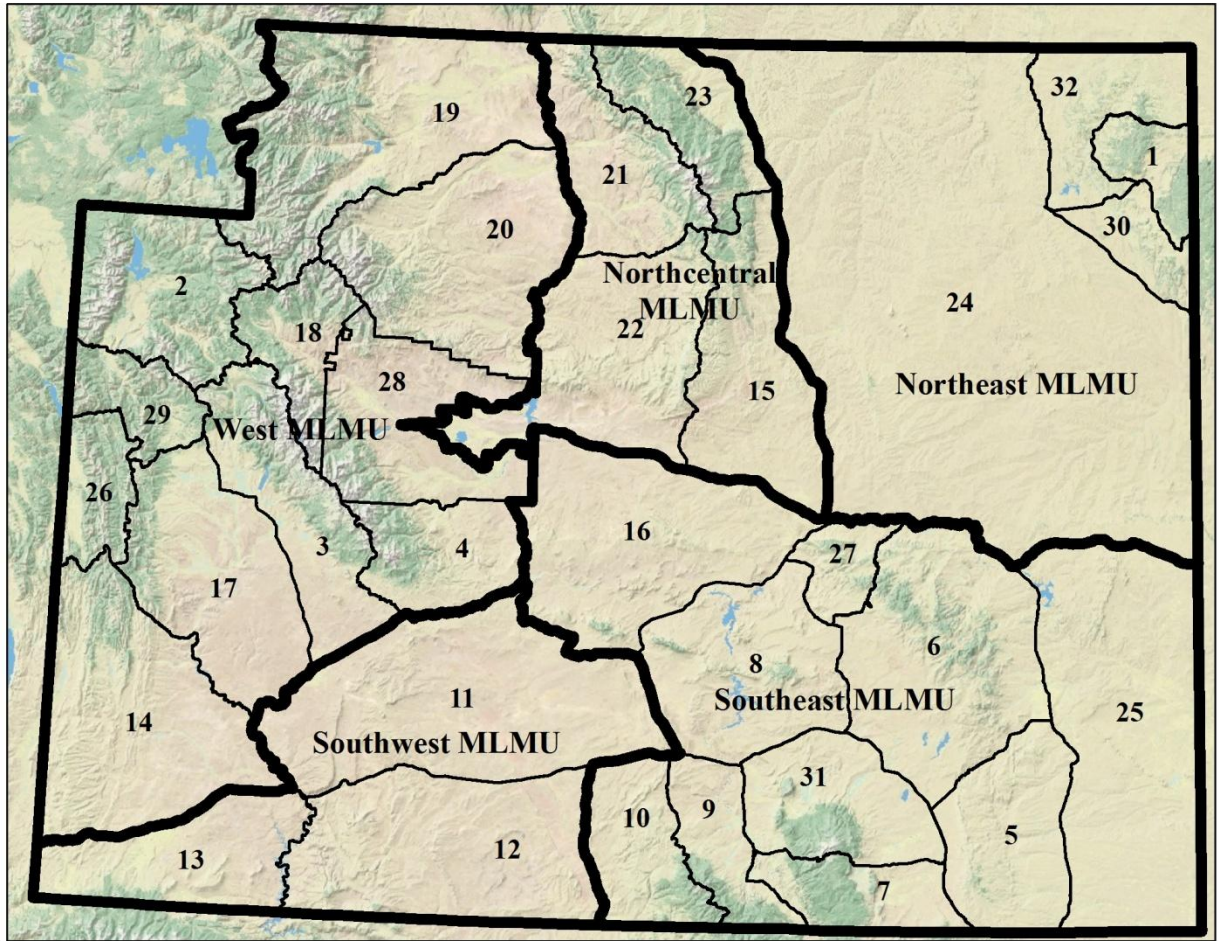


Figure 1. Hunt areas and management units for mountain lions in Wyoming. Due to the large size of the West MLMU, the Unit was separated into 3 Data Analysis Units (DAUs) including the Absaroka DAU (HAs 19 and 20), Wind River DAU (HAs 3, 4, 18, and 28), and Wyoming Range DAU (HAs 2, 14, 17, 26, and 29).

Lindzey 2005). Management objectives for MLMUs and hunt areas are determined by balancing public demands (i.e., human/lion interactions, livestock depredation, hunting/viewing opportunity) and biological requirements for sustainable lion populations across the landscape. The sex and age composition of harvested lions is compiled and analyzed statewide, for each MLMU and for each hunt area. Analyzing data by management units allows managers to evaluate harvest within specific hunt areas and assess the effects of harvest on regional populations. If observed trends are consistent with objectives set forth for each hunt area, changes in mortality limits are not recommended. However, if trends deviate from hunt area objectives, mortality limit increases or decreases may be recommended for the next 3-year management cycle. Despite the fact WGFD does not currently use mountain lion abundance to manage lions in Wyoming, 2 separate ongoing research projects are attempting to develop multiple monitoring methods to estimate abundance and movements of these animals for possible future use.

WGFD utilizes a regional scheme based on source/sink/stable population dynamics (CMWG 2005) for managing mountain lions. These terms were developed by researchers and managers based on natural movements and populations of mountain lion populations at a landscape level, where source management is akin to low levels of human-caused mountain lion mortality in order to allow for natural emigration of mountain lions. Conversely, the objective of sink management is to reduce a local population. As in all facets of wildlife management, quantification of categorical data does not necessarily fit a black and white viewpoint, but rather is more indicative of a color spectrum; therefore categorization of hunt areas occurs on a continuum from Source → Sink based on documented mortality levels and population composition. Managing for a combination of increasing, stabilizing, or decreasing mountain lion subpopulations within MLMUs (i.e., at the hunt area level) provides flexibility to address local management concerns, while maintaining overall population viability at a landscape level.

Hunt area management objectives include:

1. Sink management: REDUCE local mountain lion densities.
 - a) Maintain density of human-caused mortality >8 mountain lions/1,000 km² (386 mi²).
 - b) Achieve adult female harvest $>25\%$ of total harvest for 2 seasons.
 - c) Progression in mean age of harvested adult females should decline to <5 years old.
2. Stable management: MAINTAIN OR STABILIZE local mountain lion densities.
 - a) Maintain human-caused mortality density between 5-8 mountain lions/1,000 km² (386 mi²).
 - b) Adult female harvest should not exceed 25% of total harvest for more than 1 season.
 - c) Maintain intermediate aged adult females (mean \cong 4-6 years old) in the harvest. Adequate age evaluation may require averaging age data over time to achieve meaningful sample sizes.
3. Source management: MAINTAIN OR AUGMENT local mountain lion densities.
 - b) Maintain density of human-caused mortality <5 mountain lions/1,000 km² (386 mi²).
 - c) Maintain adult female harvest $<20\%$ of total harvest.
 - d) Maintain older-age adult females in the population (>5 years old). This will be difficult to identify without additional sampling due to low sample size from harvest, but would be expected for lightly hunted populations.

It is important to note that monitoring criteria (mortality density, proportion of adult females in the harvest, average age of adult females harvested) used to assess population status cannot be used singly when evaluating management objectives. Density of human-caused mountain lion mortality, when coupled with percentage of adult females harvested and their subsequent age, is the most effective way to assess if a hunt area is moving in a desired management direction over a 3-year period. The quantification of hunt area status is derived from an assessment of the 3 monitoring criteria in combination and possibly other data related to immigration/emigration from adjacent lion populations and habitat availability.

Acknowledging that managers rarely have precise information to measure success of management objectives, that mountain lion densities may vary regionally, and that the criteria proposed here are general guidelines; these criteria should be compared to one another and applied adaptively to assess success of management prescriptions. Applying management objectives in an adaptive management framework, where density of human-caused mortality, harvest composition, and age of harvested adult females are monitored relative to expectations (criteria above) allows assessment of whether or not management objectives are being achieved and if management strategies need to be modified to produce desired outcomes.

RELEVANT CHANGES BEGINNING IN HARVEST YEAR 2010

Before discussing mountain lion mortality data, it is important to note changes that have occurred in management criteria and regulations that impact mountain lion management in the state. Several notable changes were initiated at the beginning of the most recent 3-year cycle to evaluate their efficacy and determine if alterations were effective toward mountain lion harvest/management in the way they were anticipated. Scientifically assessing and quantifying the impacts of harvest on mountain lion populations, in addition to how lion management relates to other issues relevant to wildlife management in Wyoming, are essential for sound decision making. Evaluating and adapting management strategies (adjustment of mortality limits, season length) is the basis of adaptive harvest management. The 3 primary changes related to general harvest regulations incurred for Harvest Years (HY) 2010-2012 were:

1. Counting only legal hunter harvest and illegal kills of mountain lions toward mortality limits.
 - Note that all documented human-caused mountain lion mortalities are quantified to evaluate the status of the population.
2. Allowing unlimited harvest in Hunt Areas 15, 24, and 27.
3. Issuing reduced price, additional licenses in several hunt areas.

In addition to these changes, beginning in HY 2012, an additional hunt area was created in the Northeast MLMU incorporating portions of HAs 1 and 30 (this will be further addressed during the discussion on the NE MLMU portion of the report).

STATEWIDE MOUNTAIN LION MORTALITY

Increased mortality limits and creation of a new hunt area (HA 32 in 2012) resulted in the highest harvest of mountain lions to date in Wyoming (Figure 2). The highest density of harvest occurred primarily in the Northeast and Northcentral MLMUs, where management objectives were aimed at reducing mountain lion populations. Relative to effort, mountain lion hunters successfully harvested a mountain lion for every 3.4 days of hunting, (with some individuals hunting more than 50 days annually); 45.8% of successful mountain lion hunters harvested an

animal during one day of hunting. As documented previously, most successful hunters used dogs in order to harvest a lion (90.5% reported using dogs), but it should be noted that although not significant statistically, the percentage of mountain lions taken using other methods has increased from 7% in HY 2010 to 10.9% in HY 2012. The primary methods of take excluding use of dogs included incidental/opportunistic take, spot/stalk, tracking, and predator calling.

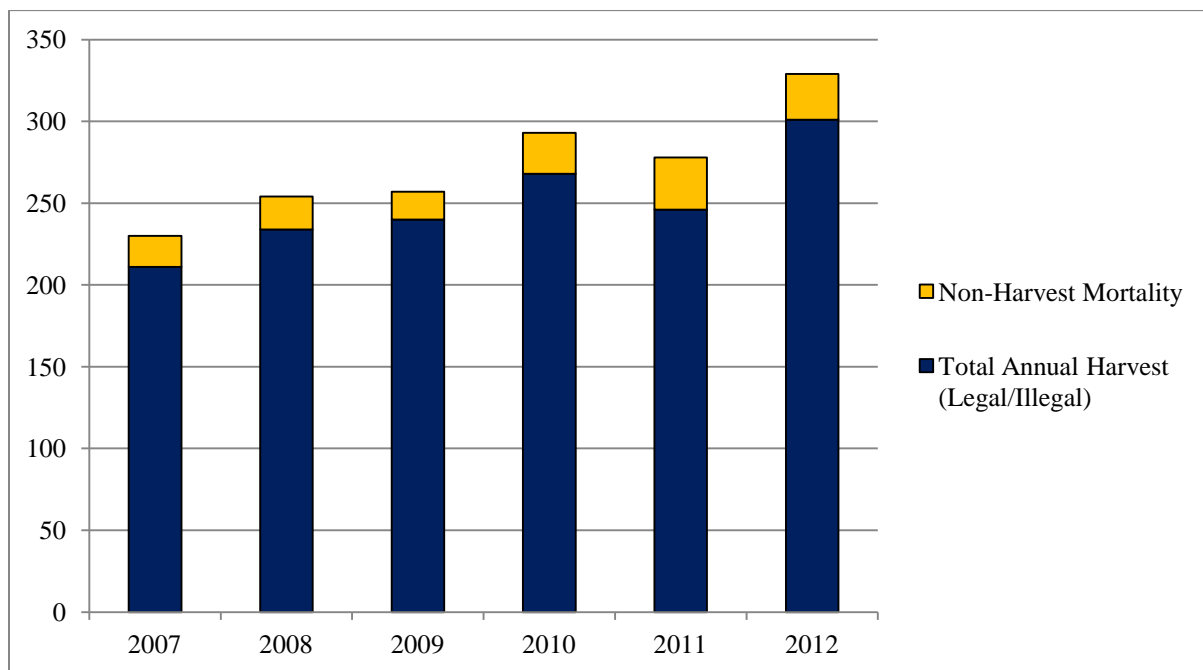


Figure 2. Annual mortality data for mountain lions in Wyoming 2007-2012 (spanning two 3-year harvest cycles).

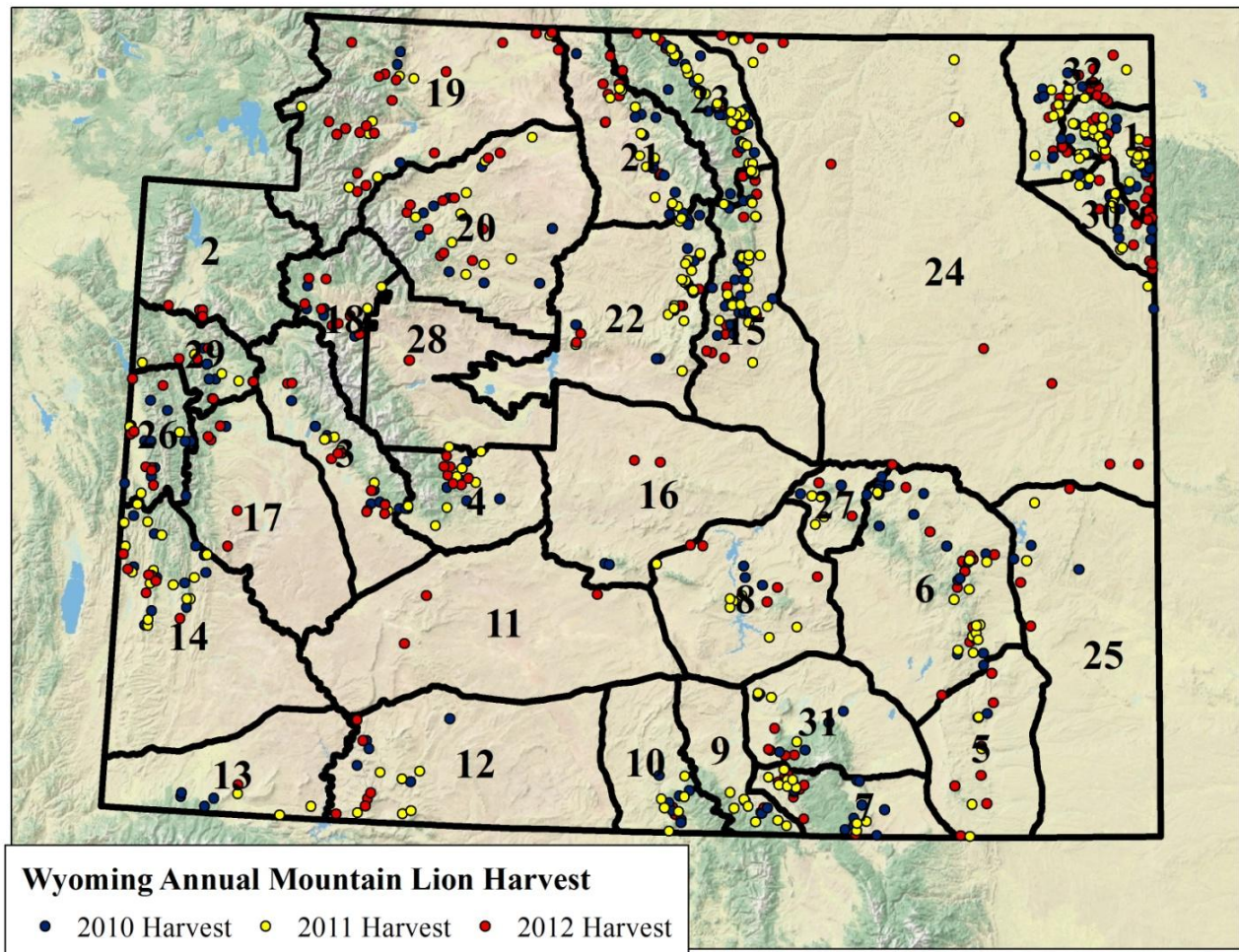


Figure 3. Map of mountain lion harvest by hunt area in Wyoming, HY 2010-2012.

In addition to harvest mortalities, 30 mountain lion mortalities were attributed to incidental trapping/snaring captures, 24 mountain lions were removed for depredation/human safety reasons, 18 vehicle mortalities were documented, and 4 self defense mortalities occurred. WGFD personnel, with assistance from members of the public and other non-governmental organizations, documented an additional 22 illegal mortalities, 7 natural mortalities, and 5 other mortalities with unknown causes of death. Incidental, non-target take (from trapping and snaring) and agency removal accounted for the majority of non-harvest mortalities. Documenting and verifying additional forms of human-caused mortalities allow managers to have better insight into population dynamics and how harvest relates to mortality limits when quantifying the density of mortality on the landscape.

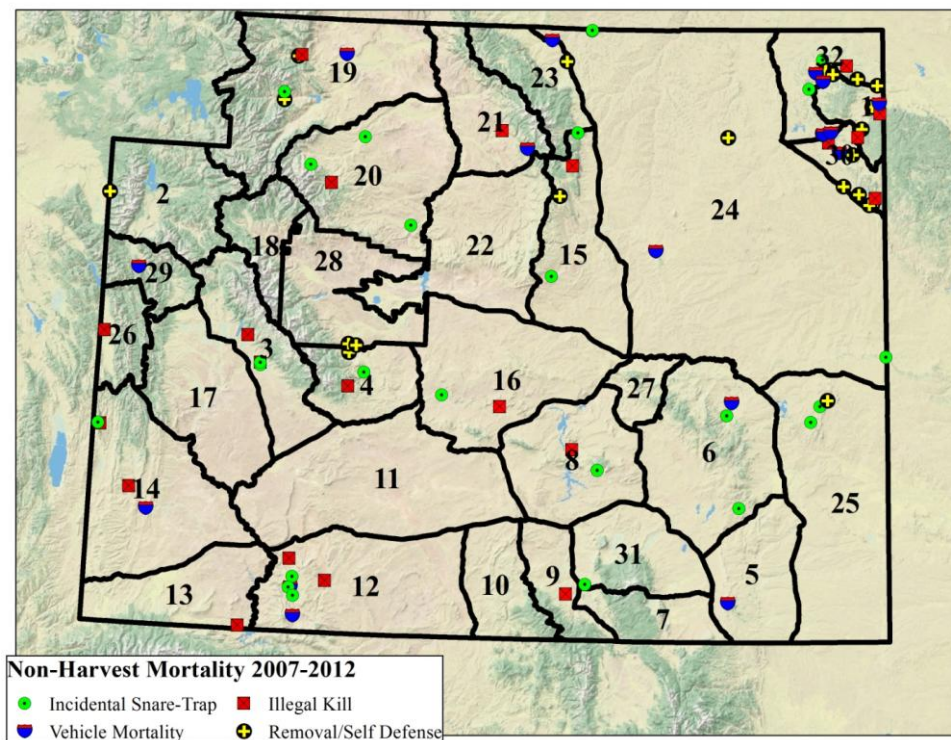
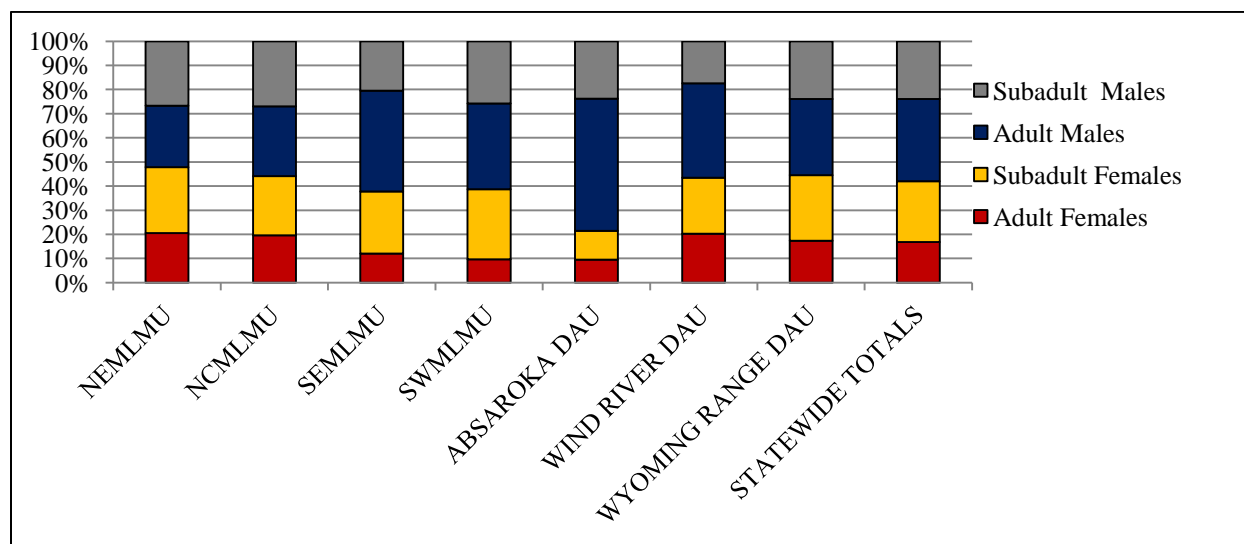


Figure 4. Map of primary forms of human-caused mountain lion mortality (excluding legal harvest) documented throughout Wyoming, 2007-2012 (Two 3-year cycles).

When comparing harvest between MLMUs, higher proportions of females were harvested in the NEMLMU and NCMLMU (Table 1). This is indicative of population reduction in certain hunt areas. Mortality limits were increased in both of these MLMUs in order to decrease mountain lion populations (Table 2 lists sex/age composition of harvest and mortality average over the 3-year harvest period; 2010-2012). The Absaroka DAU had the highest amount of male harvest (especially adult males) when compared to other areas, indicative of increased hunter selectivity and moderate mortality limits in hunt areas combined with more extensive mountain lion habitat. Adult female harvest was $\leq 20\%$ of the total harvest across all MLMUs and DAUs, indicative of long-term population viability and movement between/among hunt areas (Figure 5). Comparing across MLMUs and statewide, total females never exceeded 50% of total harvest. While certain hunt areas had higher levels of adult female harvest with concurrent population reductions, overall harvest levels appear to be moving the statewide lion population toward stabilization. Based on harvest criteria, population reduction appears to be occurring in the northeast and northcentral portions of the state and selected hunt areas in the southeast. Populations appear to be stable to increasing in many western hunt areas (See appendices for further data on hunt area specific harvest and classification).

Table 1. Summary sex/age composition of harvest by hunt area and MLMU, HY 2010-2012.

	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non- Harvest Mortality	Total Mortality	Mortality Limit
NEMLMU	33	44	41	43	161	37	198	N/A
NCMLMU	42	53	62	58	215	10	225	N/A
SEMLMU	23	49	80	39	191	19	210	268
SWMLMU	3	9	11	8	31	8	39	39
ABSAROKA DAU	4	5	23	10	42	5	47	96
WIND RIVER DAU	14	16	27	12	69	2	75	105
WY RANGE DAU	16	25	29	22	92	8	102	150
STATEWIDE	135	201	273	192	801	95	896	N/A

**Figure 5.** Sex/age composition (%) of mountain lion harvest separated by MLMU from 2010-2012.**Table 2.** Sex/age composition of mountain lion harvest by MLMU averaged over the 3-year harvest cycle.

	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non- Harvest Mortality	Total Mortality	Mortality Limit
NEMLMU	11.0	14.7	13.7	14.3	53.7	12.3	66.0	N/A
NCMLMU	14.0	17.7	20.7	19.3	71.7	3.3	75.0	N/A
SEMLMU	7.7	16.3	26.7	13.0	63.7	6.3	70.0	89.3
SWMLMU	1.0	3.0	3.7	2.7	10.3	2.7	13.0	13
ABSAROKA DAU	1.3	1.7	7.7	3.3	14.0	1.7	15.7	32.0
WIND RIVER DAU	4.7	5.3	9.0	4.0	23.0	2.0	25.0	35
WY RANGE DAU	5.3	8.3	9.7	7.3	30.7	2.7	34.0	50
STATEWIDE	45.0	67.0	91.0	64.0	267.0	31.0	298.7	N/A

MONITORING DATA AND HUNT AREA CLASSIFICATIONS

During HYs 2010-2012, management status of mountain lion hunt areas was evenly distributed (Figure 6, Table 3) across the state, with the following breakdown - Source: $n = 8$; Source/Stable: $n = 2$; Stable, $n = 5$; Stable/Sink: $n = 6$; and Sink: $n = 8$ (Three hunt areas were classified as having minimal habitat). The majority of HAs ($n = 22$) either achieved management objectives or were trending toward desired management objectives based on monitoring protocols. The Southeast MLMU had the highest diversity of hunt area management objectives. When combining harvest data among MLMUs there was a general trend of stable to increasing population status for western mountain lion populations (Table 4), stabilization of areas in the southwest and southeast, and reduction for areas in the northeast and northcentral (Table 4).

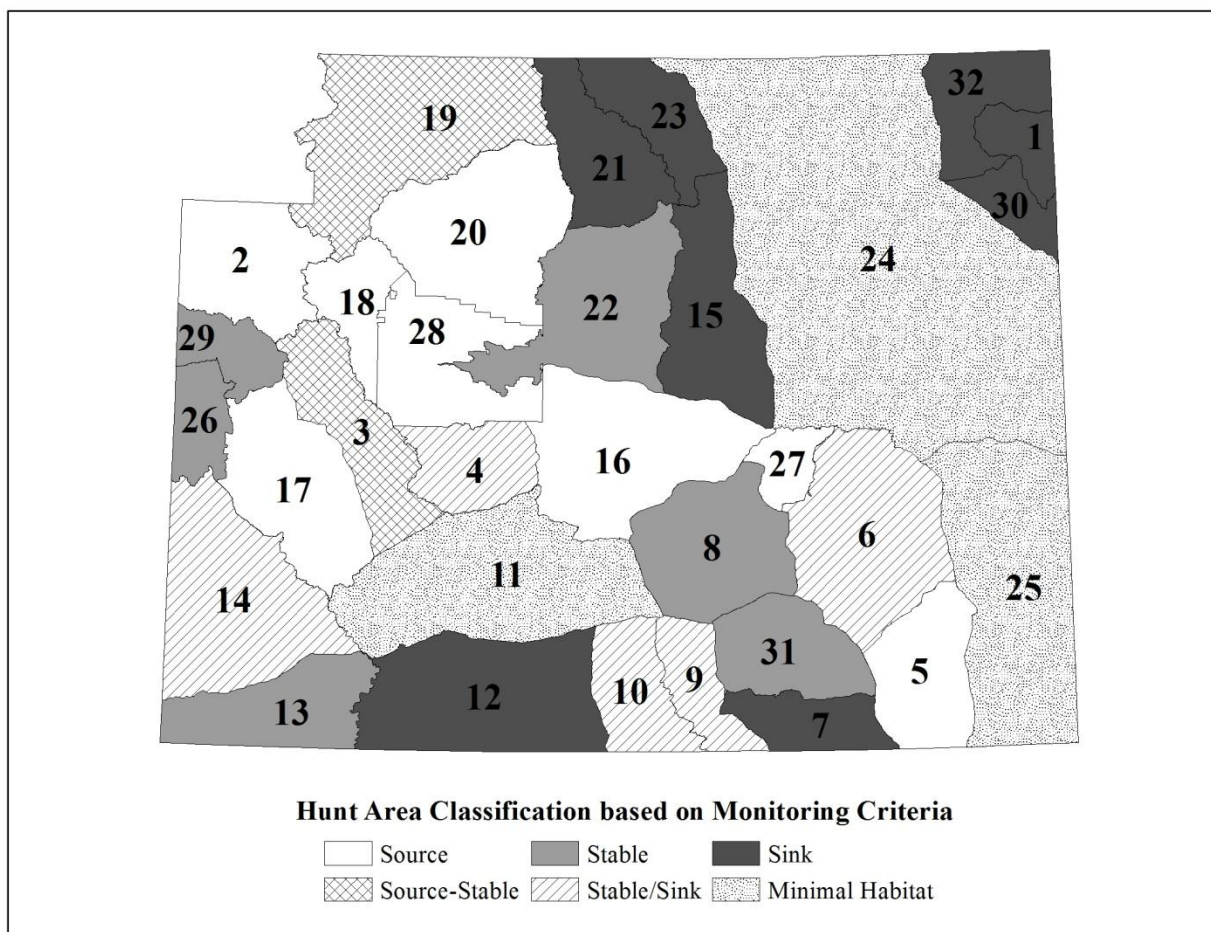


Figure 6. Statewide classification of mountain lion population trend by hunt area based on mortality data, habitat, and monitoring protocol for HYs 2010-2012.

TABLE 3. Management objectives and classifications (status) based on harvest composition, mortality as it relates to habitat and landscape for hunt areas statewide.

MLMU	Hunt Area	OBJECTIVE	STATUS
Northeast MLMU	HA 1	Sink	Sink
	HA 30	Sink	Sink
	HA 32	Sink	Sink
	HA 24	Minimal Habitat	Minimal Habitat
Northcentral MLMU	HA15	Sink	Sink
	HA21	Sink	Sink
	HA22	Sink	Stable
	HA23	Stabilize	Sink
Southeast MLMU	HA5	Source	Source
	HA6	Stabilize/Reduce	Stable/Sink
	HA7	Stabilize/Reduce	Sink
	HA8	Stable	Stable
	HA9	Sink	Stable/Sink
	HA10	Stabilize/Reduce	Stable/Sink
	HA16	Stable	Source
	HA25	Minimal Habitat	Minimal Habitat
	HA27	Sink	Source
Southwest MLMU	HA31	Sink	Stable
	HA11	Minimal Habitat	Minimal Habitat
	HA12	Stable	Sink
	HA13	Stable	Stable
Absaroka DAU	HA 19	Source/Stable	Source → Stable
	HA 20	Stable	Source
Wind River DAU	HA 3	Stable	Source → Stable
	HA 4	Stable	Stable → Sink
	HA 18	Stable	Source
	HA 28	Source	Source
Wyoming Range DAU	HA 2	Source	Source
	HA 14	Stabilize	Stable/Sink
	HA 17	Stable	Source
	HA 26	Sink	Stable
	HA 29	Source/Stable	Stable

Table 4. HY 2010-2011 mountain lion harvest data relative to WGFD monitoring criteria.

		MORTALITY DENSITY			PERCENTAGE ADULT FEMALES			AVG. AGE ADULT FEMALES		
		2010	2011	2012	2010	2011	2012	2010	2011	2012
Northeast MLMU	HA 1	14.04	17.43	15.22	0.23	0.23	0.13	4.9	4.90	3.3
	HA 30	11.76	12.83	15.54	0.06	0.35	0.15	6	5.20	4.25
	HA 32	N/A	N/A	18.56	N/A	N/A	0.28	N/A	N/A	5.3
	HA 24	4.12	7.22	10.31	0.50	0.25	0.00	4	5.00	N/A
	NEMLMU	11.21	13.66	15.49	0.18	0.28	0.17	5.00	5.00	4.33
Northcentral MLMU	HA15	25.33	25.33	13.89	0.34	0.07	0.19	5.4	4.5	4.5
	HA21	8.49	11.58	10.04	0.09	0.15	0.23	4	6.5	4.2
	HA22	7.52	6.64	4.87	0.13	0.13	0.18	5	6.67	6
	HA23	15.23	15.95	15.23	0.25	0.24	0.20	4.6	4.9	7.25
	NCMLMU	12.10	12.56	9.38	0.24	0.15	0.20	4.75	5.64	5.49
Southeast MLMU	HA5	1.72	0.69	4.13	0.20	0.00	0.17	4	N/A	4
	HA6	7.27	4.36	7.63	0.10	0.00	0.35	2.5	N/A	5.3
	HA7	11.74	9.03	9.94	0.08	0.10	0.00	3	10	N/A
	HA8	2.03	6.09	5.41	0.67	0.14	0.14	7.5	6	4.5
	HA9	7.86	11.01	6.29	0.00	0.00	0.00	N/A	N/A	N/A
	HA10	13.92	13.92	5.96	0.00	0.29	0.00	N/A	4.5	N/A
	HA16	4.89	0.00	4.89	0.67	0.00	0.00	5	N/A	N/A
	HA25	6.58	3.95	6.58	0.00	0.50	0.00	N/A	3.5	N/A
	HA27	3.05	4.07	3.05	0.00	0.00	0.00	N/A	N/A	N/A
	HA31	7.37	3.68	6.45	0.00	0.33	0.00	N/A	3	N/A
	SEMLMU	5.95	4.73	6.44	0.12	0.11	0.13	N/A	N/A	N/A
Southwest MLMU	HA11	N/A	N/A	N/A	0.00	0.00	0.00	N/A	N/A	N/A
	HA12	10.59	8.24	9.41	0.00	0.00	0.43	N/A	N/A	5.3
	HA13	7.27	7.27	3.64	0.25	0.25	0.00	3	4	N/A
	SWMLMU	8.67	7.33	6.67	0.09	0.10	0.10	N/A	N/A	N/A
Absaroka DAU	HA 19	1.36	2.45	5.99	0.00	0.00	0.15	N/A	N/A	9
	HA 20	4.25	3.93	4.91	0.00	0.00	0.23	0	0	7.67
	ABSAROKA	2.67	3.12	5.35	0.00	0.00	0.13	N/A	N/A	8.34
Wind River DAU	HA 3	4.48	4.03	4.93	0.10	0.13	0.20	4.5	N/A	6
	HA 4	7.51	8.35	6.68	0.13	0.29	0.38	6	4.5	4.17
	HA 18	3.97	1.59	5.55	0.20	0.00	0.43	8	N/A	5.3
	HA 28	0.79	1.59	0.79	0.00	0.00	0.00	N/A	N/A	N/A
	W. RIVER	3.87	3.56	4.18	0.13	0.16	0.31	6.17	N/A	5.16
Wyoming Range DAU	HA 2	0.95	0.48	2.39	0.00	0.00	0.25	N/A	N/A	6
	HA 14	7.91	6.98	4.65	0.13	0.20	0.22	8	4.8	3.5
	HA 17	0.53	0.00	2.65	0.00	0.00	0.00	N/A	N/A	N/A
	HA 26	6.09	2.77	5.53	0.18	0.20	0.10	6	5	6
	HA 29	6.31	4.73	5.52	0.33	0.00	0.33	6	N/A	4
	WY RANGE	4.18	2.68	3.86	0.18	0.17	0.18	6.67	4.90	4.88

SELECTIVITY

Through mandatory checks of all harvested mountain lions, WGFD gains valuable additional insight to further assess effects of harvest on mountain lion populations using hunter selectivity. Hunters who stated they were selective (33.6%) harvested a much lower proportion of females and a higher proportion of adult males than nonselective hunters (Figure 7). Selective hunters spent an average of 2.2 days in the field longer ($\bar{x} = 4.8$ days hunted) than nonselective hunters ($\bar{x} = 2.6$ days hunted). Age of female mountain lions harvested did not differ significantly between selective and nonselective hunters, however, selective hunters chose older males (4.4 yrs) when compared to nonselective hunters (3.6 years; $t = -4.077$, 358 df, $p = 0.0$). No differences were observed in sex/age composition of harvest when comparing outfitted vs. non-outfitted hunts or resident vs. nonresident hunters. These data suggest that hunters have the availability to select for older aged males depending on availability; however the majority of hunters were not selective while hunting mountain lions.

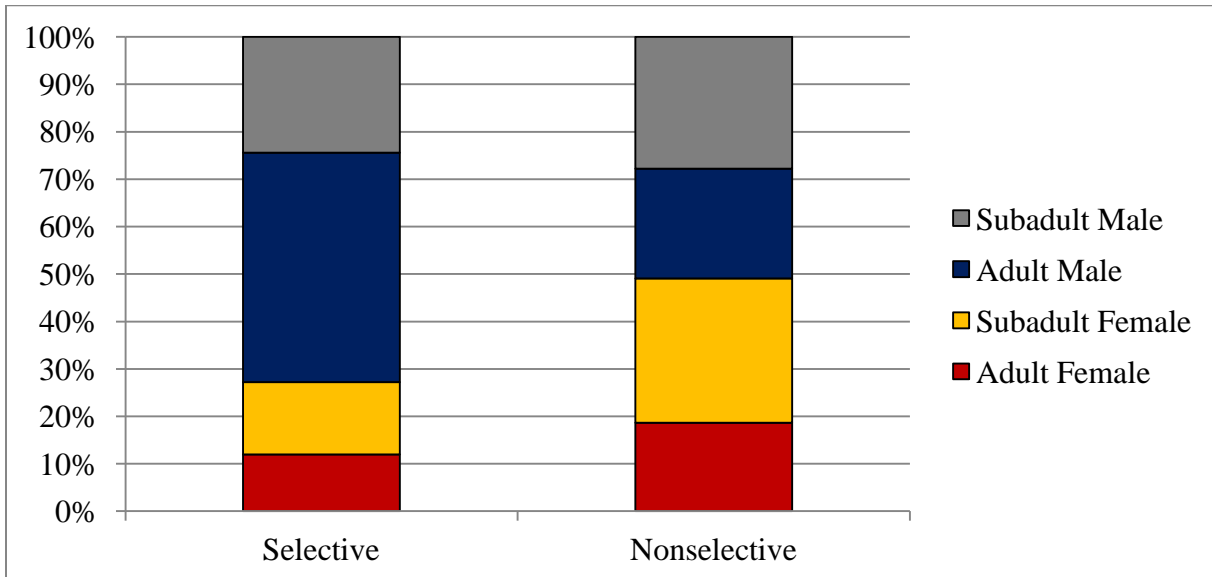


Figure 7. Comparison of sex and age composition of legal harvest for mountain lions between selective and nonselective hunters, 2010-2012.

INTERACTIONS WITH UNGULATES

Mule deer populations continue to decline in much of Wyoming and this remains a significant and continuing concern for the public and WGFD personnel. The role predation plays in these declines has not been quantified specific to Wyoming, but many segments of the public assume it is a major factor in deer mortality. During HYs 2010-2012, quotas were increased in several hunt areas to test whether lion reductions may result in improved mule deer population demographics (i.e., greater doe/fawn ratios, increased population size, etc.). In order to assess how increased mountain lion harvest may impact ungulate populations, we compared areas of high density mountain lion harvest with corresponding mule deer hunt areas. We used

regression analyses to test whether there was a positive correlation between annual mountain lion harvest in a given year with deer population composition data collected the following year to evaluate the effect, if any, of decreased mountain lion population size.

Selected mountain lion hunt areas in the NCMLMU and NEMLMU (high harvest density) were used in this analysis. For areas in the NEMLMU, we also compared mountain lion harvest data with white-tailed deer population data, as this portion of Wyoming has a large and expanding white-tailed deer herd sympatric to mule deer populations. In the NCMLMU, increasing harvest of mountain lions the past 4 years did not appear to result in a detectable increase in doe/fawn ratios for mule deer. There was, in fact, an inverse relationship between mountain lion harvest and mule deer population size, suggesting that deer populations continue to decline in spite of increased mountain lion harvest. In the Black Hills/Bear Lodge Mountains, there was no relationship between increased lion harvest and white-tailed deer population demographics. Regression analyses indicated there was a minor positive relationship between mountain lion harvest and mule deer doe-fawn ratios in the Black Hills area and northern Bighorn Mountains, but higher ratios did not result in detectable positive population level impacts to mule deer. The analyses tend to support other mule deer/mountain lion interaction studies where temporary benefits to mule deer recruitment were documented following predator reductions (Hurley et al. 2011). It should be noted that the analyses did not include variables such as habitat quality and weather indices that are also factoring into ungulate population dynamics. Since this was a simple correlative analyses, the relative importance of habitat quality and predation in deer population dynamics was not explored (Pierce et al. 2012). In order for mountain lion population reduction to benefit ungulate populations (related to neonate/juvenile survival) there must be adequate habitat in the form of nutritive intake for potentially stressed ungulate populations. If predation is considered a limiting factor, deer populations not suppressed by quality habitat can respond in the short term to predator reductions (Pierce et al. 2012).

In summary, to accurately assess how mountain lion harvest relates to ungulate populations quantitatively, managers must take into account variables including weather, habitat, and body condition of ungulates and some assessment of cause-specific mortality (Hurley et al. 2011). An additional report will be published approximately 1 year from now that examines ungulate population demographics following the current mountain lion harvest year. Results reported herein do not have an evaluation of the impacts of the final year of mountain lion harvest to ungulate population dynamics as these data are obviously not yet available. The final analysis will be appended when ungulate population demographic data are available, representing the most up to date ungulate population level response to mountain lion harvest.

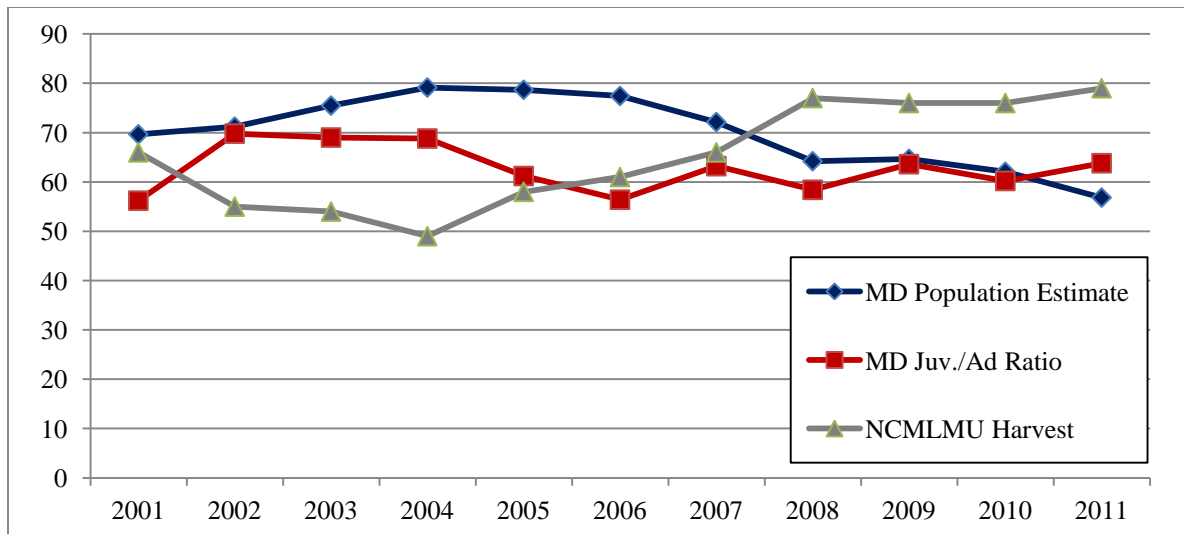


Figure 8. Trend data comparing mule deer (MD) population estimate index, mule deer juvenile/adult ratios and mountain lion harvest in corresponding mule deer and mountain lion hunt areas in the NCMLMU. The population estimate index is simply the annual population index scaled by 1000 in order to portray graphically with harvest and ratio data.

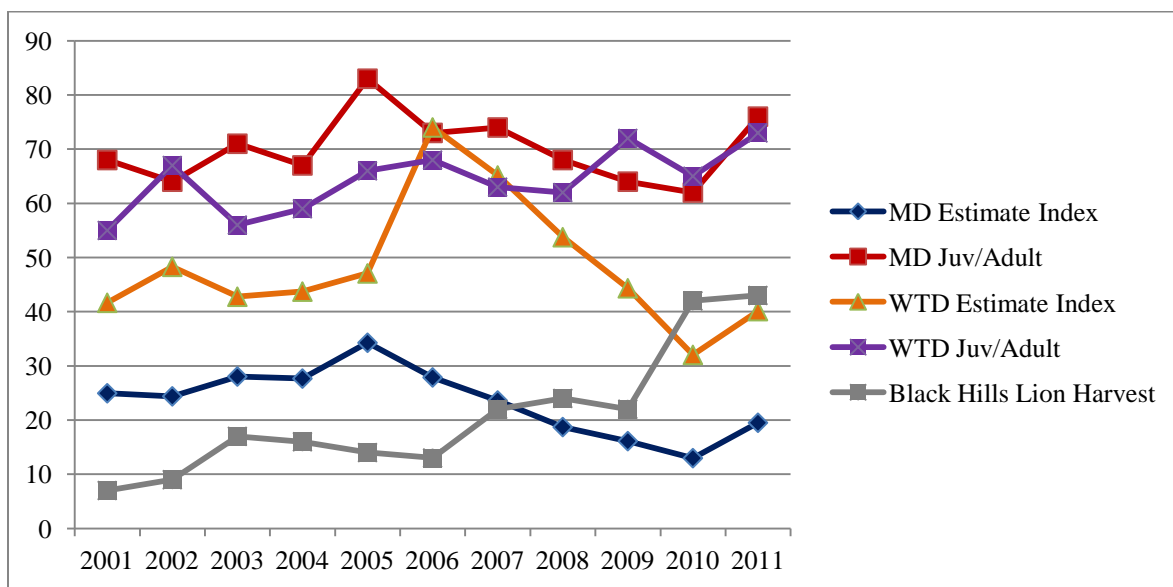


Figure 9. Trend data comparing white-tailed (WTD) and mule deer (MD) population estimate index, juvenile/adult ratios, and mountain lion harvest in corresponding deer and mountain lion hunt areas in the NEMLMU. The population estimate index is simply the annual population index scaled by 1000 in order to portray graphically with harvest and ratio data.

MOUNTAIN LION HARVEST AS IT RELATES TO CONFLICT

A factor of critical importance when evaluating management and long term viability and public acceptance of mountain lion populations is assessment of mountain lion/human interactions (Apker et al. 2011). Public sentiment and support for large carnivores are influenced by localized conflicts where mountain lions threaten property/human safety/livestock. In Wyoming we have significant regional divergences; with areas where stakeholders view mountain lions as a nuisance and threat, versus ideologies where people view mountain lions as supernatural beings beyond the realm of wildlife conservation and management, and all variations in between. Factors such as mountain lion density as it relates to human and livestock density and prey availability/density can impact how mountain lions react behaviorally to encounters with humans and livestock (Sweaner and Logan 2010, Bodenchuck 2011). It is the responsibility of WGFD to minimize mountain lion depredation to pets and livestock and reduce the potential for human harm (WGFD 2006); generally accomplished through site-specific removal of offending individuals. These types of management actions (i.e., lethal removal, relocation) are taken into account when analyzing mountain lion population demographics and during the development of mortality limits on a hunt area and management unit level.

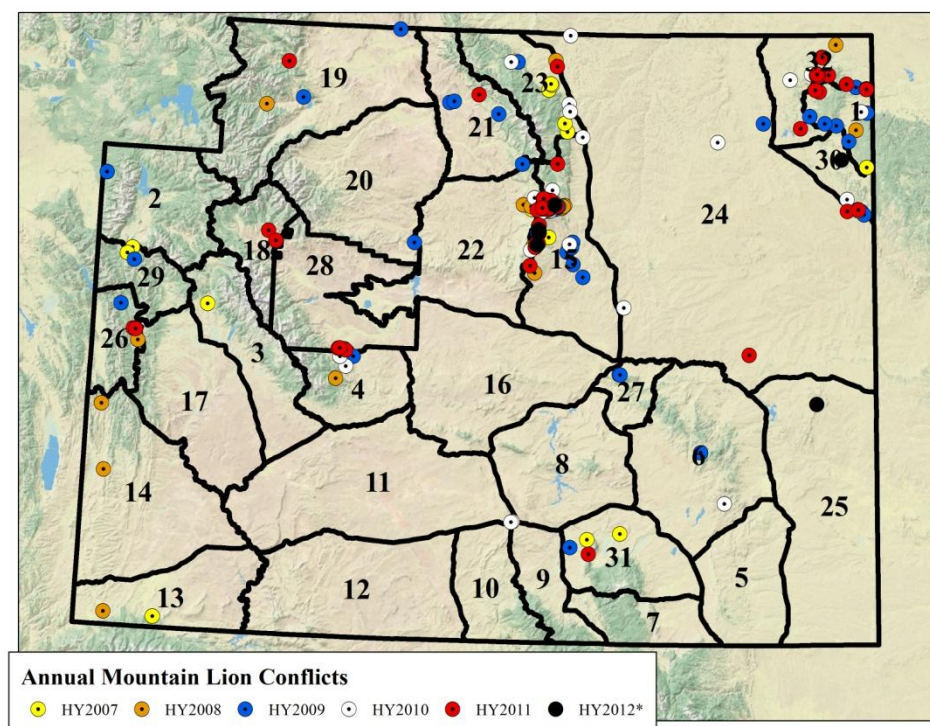


Figure 10. Annual verified mountain lion conflicts throughout Wyoming from 2007-2012. Data for 2012 are incomplete in that the harvest year does not conclude until 31 August 2013. General sightings and nonaggressive encounters were not included.

To evaluate how mountain lion harvest and population status relate to conflict, we focused on hunt areas with sustained or increased level of annual mountain lion mortality and compared

confirmed livestock depredation incidents within the corresponding mountain lion hunt area (Figure 10). The southern Bighorn Mountains continue to have the highest precedent of mountain lion livestock depredation (sheep), and subsequently, mountain lion mortality limits have been adaptively increased in order to reduce the lion population sympatrically with sheep grazing allotments.

Despite elevated levels of harvest in both the NCMLMU and NEMLMU, we did not document a corresponding decrease in livestock depredation, rather there was a positive correlation with increased mountain lion harvest and increased amount of damage monies paid for compensation in relation to sheep depredation. It has been hypothesized that sustained high harvest density of mountain lions may in turn create more problems related to conflict based on mountain lion home range turnover and younger age structure.

Specific to the NEMLMU, we will evaluate how the increased harvest in the new formed HA32 will potentially impact conflict and depredation issues in the private land communities comprising Area 32. The impacts of the directed harvest on private land within the area will provide better insight into how mountain lion harvest relates to conflict/depredation resolution. The WGFD maintains a zero-tolerance policy for confirmed mountain lion livestock depredation and this continues to be an effective and viable management tool in order to deal with situations pertaining to mountain lion/livestock interactions.

As with analyses comparing ungulate populations to mountain lion harvest, an addendum to this report will be published one year from now with a complete analysis of how mountain lion harvest relates to conflict and livestock depredation, incorporating conflict data occurring after HY 2012. Inclusion of conflict and depredation data through this current spring and summer grazing period, especially as it relates to the inclusion of an additional hunt area (HA 32) in the northeast, will allow for a more reliable evaluation of potential impacts to conflict as a result of increased mountain lion harvest.

INFORMATION AND EDUCATION

WGFD provides a variety of information and education (I&E) programs concerning large carnivores to provide credible and current information to Wyoming's citizens. I&E programs are an essential component of wildlife management and critical toward responsibly shaping the public's views toward management of mountain lions and all species of resident or migratory wildlife. A primary responsibility of WGFD is to solicit input to adequately consider public desires for the management of their wildlife resources. All data included in this report, along with I&E efforts and damage management are performed to maintain public support for and understanding of this solitary carnivore.

DISCUSSION

Overall, mountain lion harvest increased during HYs 2010-12, largely driven by increased and/or sustained harvest in the Northeast and Northcentral MLMUs. Across Wyoming, harvest fluctuated annually, depending on tracking conditions, mortality limits, lion densities, and local hunter effort. In total, adult females comprised 16.9% of the harvest (total female harvest of 41.9%), with an overall density of 6.31 human-caused mortalities/1,000 km² of mountain lion habitat. Based on Wyoming's current management criteria, these statistics are indicative of a stable to increasing mountain lion population across the state. Current harvest management appears to have been successful at maintaining long term viability of the species, while allowing directed higher harvest pressure in areas where needed. The use of an unlimited quota in 3 Wyoming hunt areas did not result in increased harvest or decreased mountain lion conflicts. The inclusion of additional reduced price licenses did not appear to increase harvest in areas where these licenses were valid. However, it was difficult to determine whether harvest effort changed solely based on use of the additional license system.

The use of WGFD's source/stable/sink harvest management criteria accounts for the transient nature of sub-adult mountain lions (Sweaner et al. 1990, Thompson and Jenks 2010) and can result in repopulation of vacant home ranges by new individuals (Robinson et al. 2008, Newby et al. 2013). While the terms "source/stable/sink" may be misinterpreted, simply stated, source populations are considered to have stable to increasing resident mountain lion populations with low human-caused mortality. The term source is sometimes confused with the concept of a "refuge" where no legal harvest of animals is allowed, similar to national parks. Some areas, while managed as a "source," may not function biologically as a source population for adjacent areas, but are managed so that human caused mortalities (e.g. harvest) are not detrimental to the local mountain lion population. Stable status is indicative of population stabilization, where mountain lion populations fluctuate annually, allowing for recreational harvest opportunity and the natural ebb and flow of this species in relation to prey availability and habitat. Sink population management is intended to reduce a local mountain lion population through increased legal harvest. Sink areas are assigned higher mortality limits per unit area, resulting in higher levels of harvest and higher proportions of females harvested.

WGFD continues to collect data in order to better manage mountain lions and increase our knowledge of the species' role and function in the state. Currently, the Department is working collaboratively with the Teton Cougar Project to assess efficacy of multiple noninvasive monitoring techniques for possible use in conjunction with current harvest analyses to evaluate population trend. The Department is similarly exploring the use mark-recapture analyses using genetic sampling methods to estimate abundance and movement of mountain lions on a landscape level such as multiple hunt areas or potentially management units depending on effort. Results of these efforts will be incorporated into annual reports and, if proven effective, potentially used to more accurately monitor mountain lions in the state.

As wolf and grizzly bear populations expand their density and distribution, it is critical to evaluate how an intact large carnivore guild interacts with among species and their combined impacts to both wild and domestic ungulates in order to better understand the intricacies of predator/prey relationships in Wyoming and western North America. The Large Carnivore Section is involved with all aspects of monitoring, management, and conflict resolution of black and grizzly bears, wolves, and mountain lions and the goal of the section is to maintain viable and recovered (in the case of wolves and grizzly bears) populations of these species for perpetuity, while maintaining and augmenting public support and tolerance of large carnivores on the landscape. This will be accomplished through persistent communication and transparency to the public, while dealing with the realities of managing large carnivores and their positive and negative contributions as a whole to the diverse ecosystems.

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APPENDICES

Further Data and Discussion Related to Specific Hunt Area Classification and Monitoring Criteria

Separated by MLMU



NOTE ON UPCOMING FIGURES: The figures reported within appendices are meant to give the reader further clarification related to hunt area classification. Certain figures or hunt areas were omitted from inclusion depending on sample size and data available. Each MLMU contains at least 1 figure that illustrates density of mountain lion mortality by hunt area and MLMU over the 3-year monitoring period. When applicable, figures were included to illustrate percentage of adult female harvest and adult female ages if data were pertinent to the discussion and classification of hunt areas. For proportion of adult females harvested, the decimal numbers on the y-axis are on a scale of 0.0 – 1.0 of total harvest (i.e., 0.25 = 25%). The transparent red bands on the figures are to further illustrate criteria related to source, stable, or sink; where within the band is indicative of stable classification, above the band is indicative of sink and below is indicative of source.

APPENDIX I. NORTHEASTERN MOUNTAIN LION MANAGEMENT UNIT

The Northeastern MLMU (NEMLMU) consists of 4 Hunt Areas (1, 24, 30, and 32). During the summer of 2012 after several public meetings and regional WGFD deliberation, Hunt Area 32 was created primarily to direct harvest onto private land surrounding the Bear Lodge Mountains in Hunt Area 1. The mountain lion population in northeast Wyoming is unique in that it is not contiguously connected to other Wyoming mountain lion populations to the West and Southwest, and the majority of the mountain lion population occurs in South Dakota. It also represents a population that naturally recolonized the area, with the Black Hills and Bear Lodge having a nearly if not entirely extirpated mountain lion population through the majority of the 20th Century. The Black Hills are also the most heavily roaded National Forest in North America making the area conducive to track searching. Due to the expanding population, readily accessible terrain, and high hunter effort, Hunt Areas 1 and 30 are annually the first hunt areas to close due to reaching mortality limits.

Excluding HA 24, harvest has remained high in the NEMLMU with a high density of mortality across the landscape, a relatively high proportion of adult females taken and through time a reduction in the age structure suggesting a reduction in the resident population. There is immigration occurring from the portion of the Black Hills within South Dakota, which partially accounts for the young age structure of harvest and continued presence of animals despite heavy harvest.

Hunt Area 1: Based on the high density of mountain lion mortality, along with moderate proportion of females in the harvest and a decreasing age of females harvested, maintaining these levels of harvest annually will result in a reduction the resident population in Area 1 (Sink).

Hunt Area 30: Increased hunting pressure has resulted in increased harvest and reduction in the resident mountain lion population (Sink).

Hunt Area 24: Hunt Area 24 does not contain a large amount of contiguous high quality mountain lion habitat. Mountain lions occur throughout the region but many are transient providing immigration between the Black Hills, Bighorns and Laramie Range.

Hunt Area 32: Hunt Area 32 was created in the final year of the Harvest Cycle (2012). The high density of mortality and high amount of adult female harvest suggest that harvest did have an impact on the resident mountain lion population surrounding the Bear Lodge Mountains. Further evaluation will be required to evaluate the efficacy of initiation of this Hunt Area. Management objective is to reduce the population due to high amount of private land and animal husbandry occurring throughout.

Table A1. Annual mountain lion mortality data for the Northeastern MLMU, Harvest Years 2010-2012.

Hunt Area/ HY 2010	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA1	6	8	4	8	26	3	29	24
HA30	1	4	4	7	16	6	22	16
HA24	1	0	0	1	2	2	4	Unlimited
2010 Total	8	12	8	16	44	11	55	N/A

Hunt Area/ HY 2011	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA1	6	8	4	8	26	10	36	24
HA30	6	4	5	2	17	7	24	16
HA24	1	0	2	1	4	3	7	Unlimited
2011 Total	13	12	11	11	47	20	67	N/A

Hunt Area/ HY 2012	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA1	3	9	7	5	24	0	24	24
HA30	2	2	6	3	13	2	15	12
HA24	0	3	2	3	8	2	10	Unlimited
HA32	7	6	7	5	25	2	27	25
2012 Total	12	20	22	16	70	6	76	N/A
3 Year Sum	33	44	41	43	161	37	198	N/A
3 Year Mean	11.0	14.7	13.7	14.3	53.7	12.3	66.0	N/A

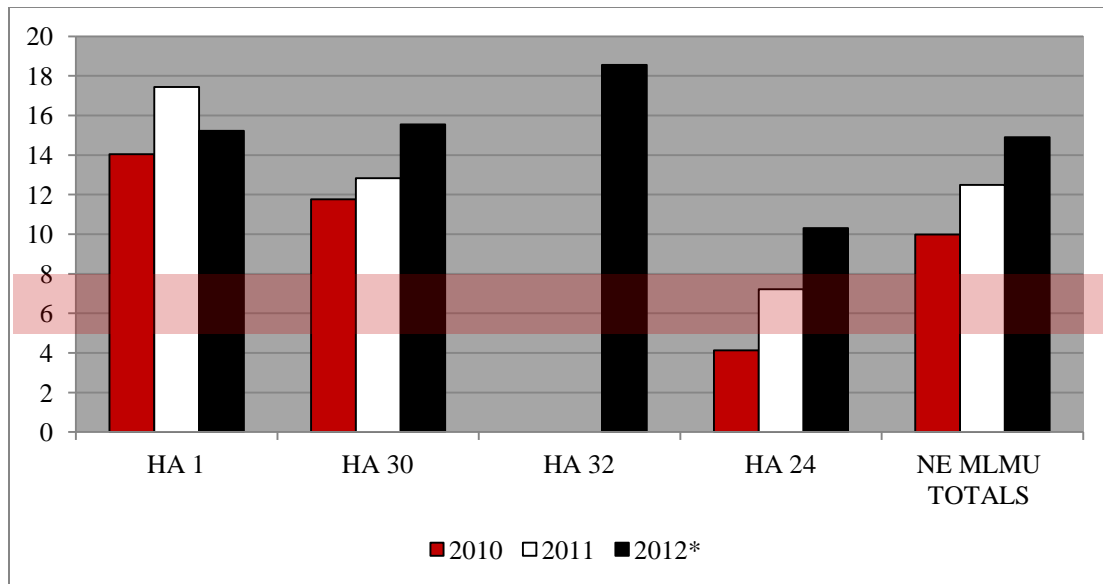


Figure A1. Total density of mountain lion mortality calculated from an annual summary of all human-caused mountain lion mortality per 1,000 km² of quantified mountain lion habitat, separated by Hunt Area and MLMU.

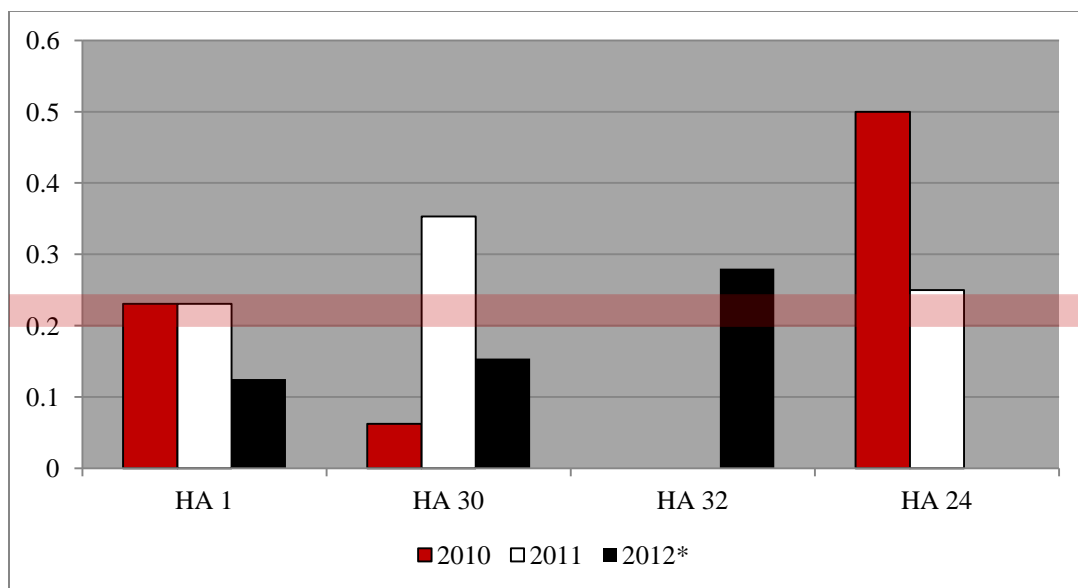


Figure A2. Proportion of adult females harvested annually separated by Hunt Area and MLMU. Age class for female mountain lions is determined by lactation status.

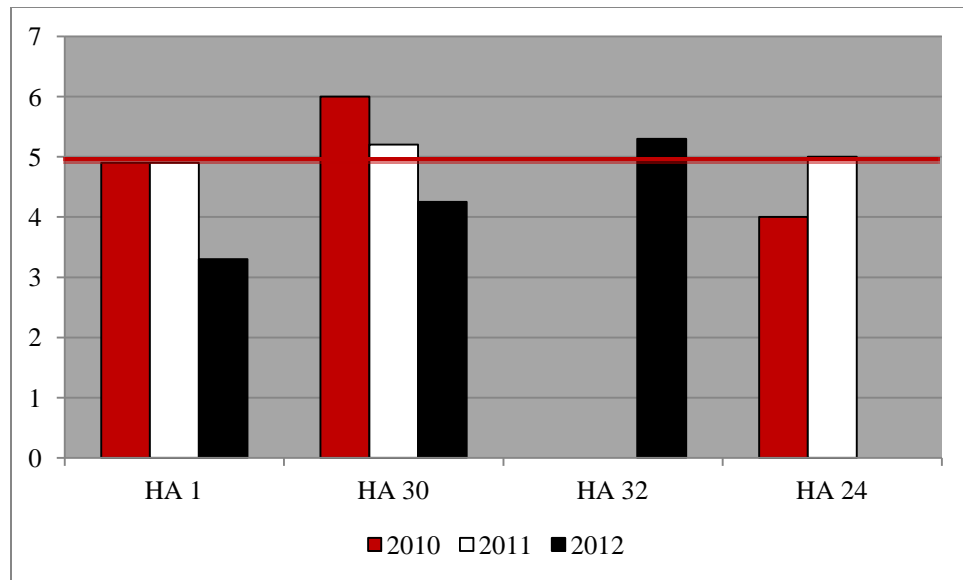


Figure A3. Mean age of adult females harvested annually separated by Hunt Area.

APPENDIX II. NORTHCENTRAL MOUNTAIN LION MANAGEMENT UNIT

Mortality limits for Hunt Areas in the Northcentral MLMU have been set high primarily because of issues of sheep depredation as well as long history of high lion harvest in the area. Despite the high amount of harvest and other human caused mortality (primarily from depredation control) mortality limits are generally reached annually in the Bighorn Mountains. There is likely immigration occurring to the Bighorns from the West and Southwest as well as documented immigration from the east (Thompson and Jenks 2010), and it is speculated that due to the high number set for mortality limits in the NCLMU. Based on monitoring protocols, it appears that overall the lion population in the Northcentral MLMU is functioning as a sink, mainly due to high density of mortalities/1,000 km² and a decrease in the age of adult females harvested. A reduction in the resident population has in turn provided vacated home ranges to be encountered by transient individuals potentially laying the foundation for higher mountain lion densities and younger age structure depending on the level of immigration.

Hunt Area 15: Consistently high density of mountain lion mortalities suggest HA 15 is serving as a population SINK. Due to the high quality habitat, proximity to immigration from other populations it is likely there is a high proportion of transient individuals moving through HA15. This may result in the impression of higher density of resident lions or may allow for usurpation of vacated home ranges from transient potentially resulting in a younger age structure resident population. Use of unlimited quota system did not increase harvest in HA 15.

Hunt Area 21: High density of mountain lion mortalities and overall young age structure of harvested individuals suggest harvest has reduced the resident mountain lion population (Sink).

Hunt Area 22: Despite increased harvest from 2010-2012 the large amount of quality habitat and likely immigration from western areas (Absaroka and Owl Creek Mountains, Wind River Reservation) suggest harvest is acting toward stabilizing the resident population.

Hunt Area 23: High density of mortalities suggest HA 23 is serving as a SINK. It should be noted that the high level of harvest of mountain lions in the Bighorn Mountains have reduced the resident mountain lion population, but immigration between and among hunt areas suggest a great amount of turnover between local and surrounding mountain lion populations.

Table A2. Annual mountain lion mortality data for the NorthCentral MLMU, Harvest Years 2010-2012.

Hunt Area/ HY 2010	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA15	10	4	3	12	29	2	31	Unlimited
HA21	1	2	6	2	11	0	11	20
HA22	2	6	8	0	16	1	17	25
HA23	5	6	5	4	20	1	21	20.0
2010 Total	18	18	22	18	76	4	80	N/A

Hunt Area/ HY 2011	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA15	2	6	10	12	30	1	31	Unlimited
HA21	2	4	5	2	13	2	15	20
HA22	3	4	3	5	15	0	15	25
HA23	5	11	4	1	21	1	22	20
2011 Total	12	25	22	20	79	4	83	N/A

Hunt Area/ HY 2012	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA15	3	2	7	4	16	1	17	Unlimited
HA21	3	1	2	7	13	0	13	20
HA22	2	3	5	1	11	0	11	25
HA23	4	4	4	8	20	1	21	20
2012 Total	12	10	18	20	60	2	62	N/A
3 Year Sum	42	53	62	58	215	10	225	N/A
3 Year Mean	14.0	17.7	20.7	19.3	71.7	3.3	75.0	N/A

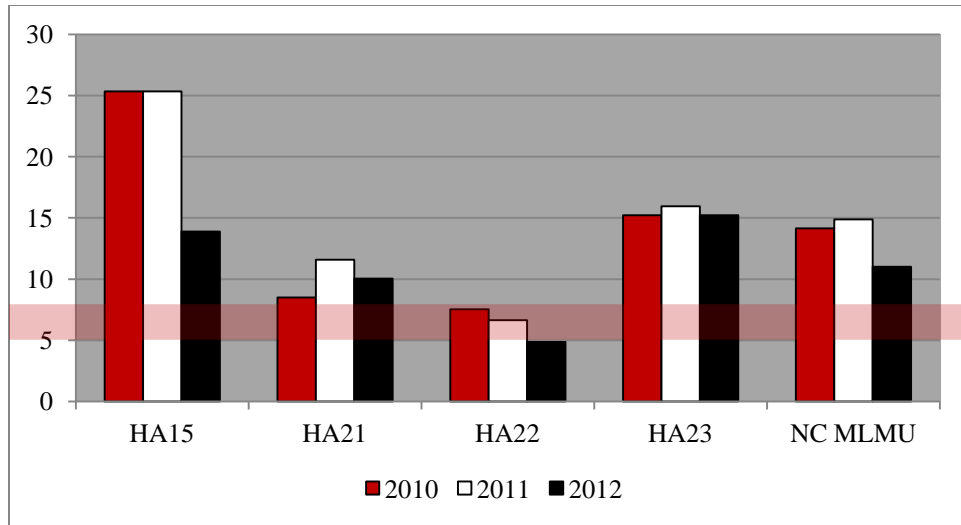


Figure A4. Total density of mountain lion mortality calculated from an annual summary of all human-caused mountain lion mortality per 1,000 km² of quantified mountain lion habitat, separated by Hunt Area and MLMU.

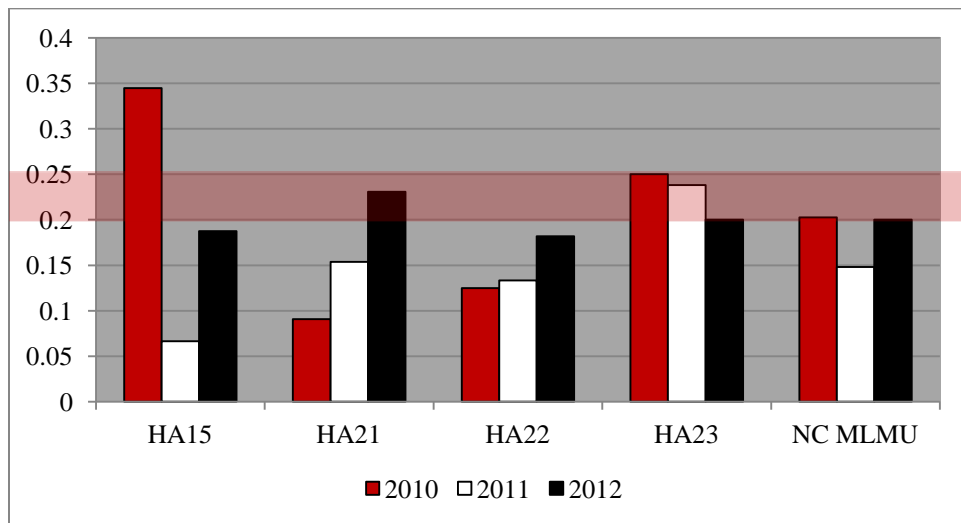


Figure A5. Proportion of adult females harvested annually separated by Hunt Area and MLMU. Age class for female mountain lions is determined by lactation status.

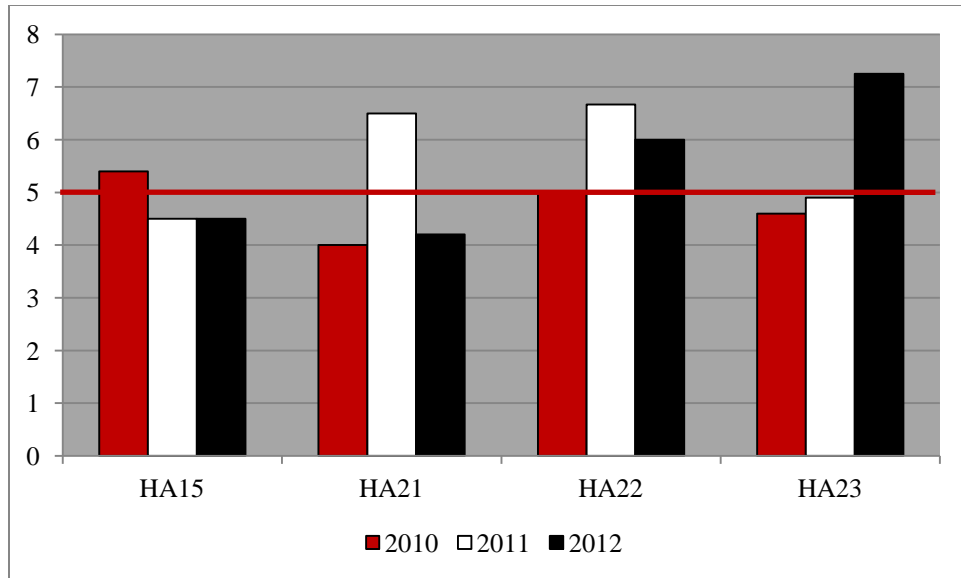


Figure A6. Mean age of adult females harvested annually separated by Hunt Area and MLMU.

APPENDIX III. SOUTHEASTERN MOUNTAIN LION MANAGEMENT UNIT

The Southeastern LMU consists of 9 Hunt Areas with differing management strategies and over 12,000 km² of preferential winter lion habitat. The SEMLMU is an excellent example of attempting to manage lion populations on a local level while providing for long term population viability on a larger scale. The SELMU has all variations of Hunt Area status classifications (i.e., source – sink and variations between), but the overall MLMU classifies as stable.

Hunt Area 5: Low harvest in HA 5 suggest the area is serving as a source population. Harvest was highest on record in HY 2012.

Hunt Area 6: Since increasing mortality limits in 2010, harvest has increased in HA 6. Level of harvest is likely moving toward population stabilization and potential decrease if harvest levels are maintained.

Hunt Area 7: Increased harvest is reducing the resident population, immigration is occurring as this small hunt area is connected to the larger mountain lion population throughout the Snow Range.

Hunt Area 8: Increased harvest (moderate mortality density and female take) suggest there is some population stabilization/reduction occurring. Likely a low overall density of mountain lions throughout the Hunt Area, but sex/age composition suggest a healthy viable population and stable status.

Hunt Area 9: Increased level of take have likely resulted in a decrease in the mountain lion population, however a low proportion of adult females have been harvested. Population reduction was the objective in order to potentially augment local mule deer populations (Sink).

Hunt Area 10: Despite low female harvest, increasing mortality densities suggest HA 10 may be moving toward a reduction (Sink) from an overall stable status. Again that was the objective as with HA 9.

Hunt Area 16: Low to moderate levels of harvest suggest the mountain lion population in HA 16 is STABLE.

Hunt Area 25: Sporadic harvest in HA 25 and minimal amount of contiguous habitat suggest that the area is serving its purpose of providing dispersal habitat for transient individuals.

Hunt Area 27: Despite having an unlimited quota, harvest has remained low in HA27 and is classified as a Source. Biologically it may to be serving as a source population, but mortality due to human activity is low in Area 27.

Hunt Area 31: Harvest in HA 31 was in line with mortality limits. Moderate density of mortalities and female lion harvest suggest HA 31 is stable.

Table A3. Annual mountain lion mortality data for the Southeastern MLMU, Harvest Years 2010-2012.
(*Total mortality limit does not include unlimited quota in HA27.)

Hunt Area/ HY 2010	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA5	1	1	2	1	5	0	5	12
HA6	2	9	5	4	20	0	20	21
HA7	1	3	6	3	13	0	13	14
HA8	2	0	1	0	3	0	3	10
HA9	0	1	2	2	5	0	5	7
HA10	0	2	3	2	7	0	7	7
HA16	2	0	1	0	3	1	4	6
HA25	0	0	2	1	3	2	5	3
HA27	0	0	3	0	3	0	3	Unlimited
HA31	0	1	4	1	6	2	8	6
2010 Total	8	17	29	14	68	5	73	86*
Hunt Area/ HY 2011	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA5	0	0	1	1	2	0	2	12
HA6	0	4	8	0	12	0	12	21
HA7	1	5	2	2	10	0	10	14
HA8	1	2	3	1	7	2	9	10
HA9	0	4	1	2	7	0	7	7
HA10	2	3	0	2	7	0	7	7
HA16	0	0	0	0	0	0	0	6
HA25	1	0	0	1	2	1	3	3
HA27	0	1	3	0	4	0	4	Unlimited
HA31	1	1	0	1	3	1	4	6
2011 Total	6	20	18	10	54	4	58	86*
Hunt Area/ HY 2012	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA5	2	2	6	2	12	0	12	12
HA6	6	3	7	1	17	4	21	21
HA7	0	2	8	1	11	0	11	14
HA8	1	2	3	1	7	1	8	10
HA9	0	0	3	0	3	1	4	12
HA10	0	0	1	2	3	0	3	7
HA16	0	0	1	2	3	1	4	6
HA25	0	0	0	3	3	3	6	3
HA27	0	0	1	2	3	0	3	Unlimited
HA31	0	3	3	1	7	0	7	11
2012 Total	9	12	33	15	69	10	79	96*
3 Year Sum	23	49	80	39	191	19	210	268*
3 Year Mean	7.7	16.3	26.7	13.0	63.7	6.3	70.0	89.3*

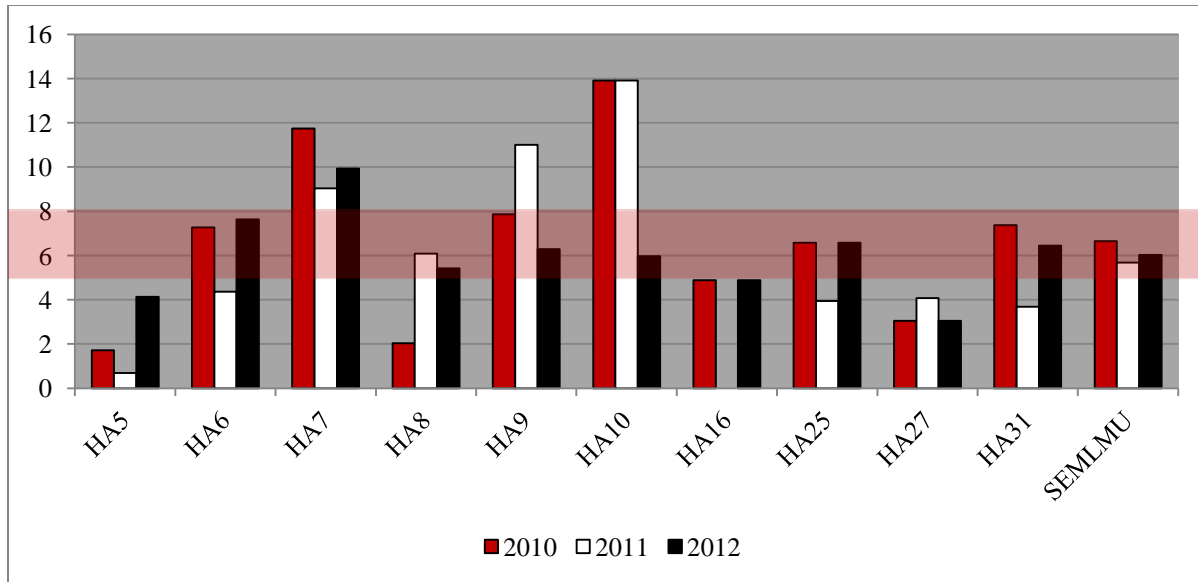


Figure A7. Total density of mountain lion mortality calculated from an annual summary of all human-caused mountain lion mortality per 1,000 km² of quantified mountain lion habitat, separated by Hunt Area and MLMU.

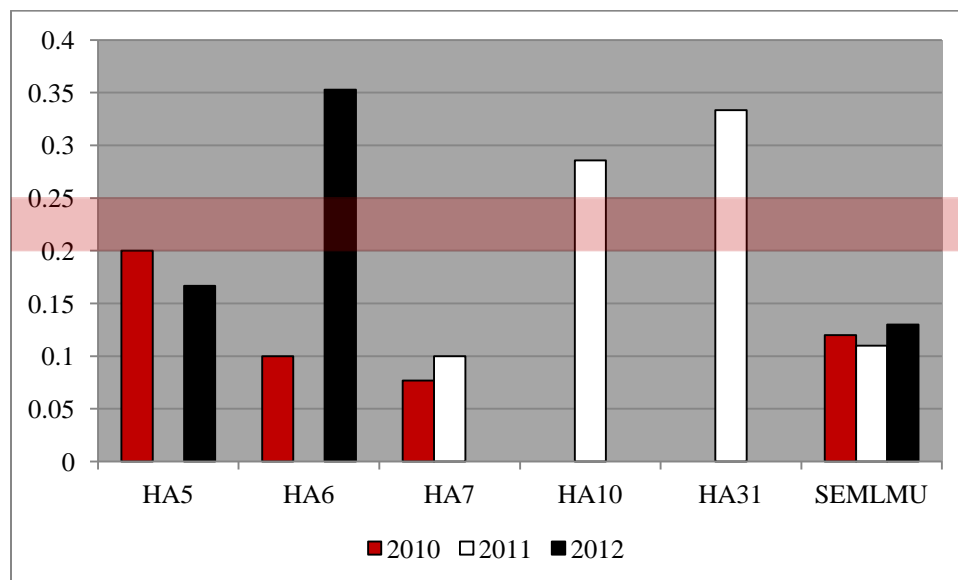


Figure A8. Proportion of adult females harvested annually for select Areas in the SEMLMU, separated by Hunt Area and MLMU. Age class for female mountain lions is determined by lactation status.

APPENDIX IV. SOUTHWESTERN MOUNTAIN LION MANAGEMENT UNIT

The Southwestern MLMU consists of Hunt Areas 11, 12, and 13. HA 11 does not have enough contiguous mountain lion habitat in order to manage for the species, however it does contain habitat linkage areas and pockets of habitat that transient lions use while dispersing. Hunt Areas 12 and 13 likely acquire immigration from the Uinta Range to the south.

Hunt Area 11: HA 11 lacks a high amount ($< 1,000 \text{ km}^2$) of contiguous mountain lion habitat and we are not managing for stable or increasing lion populations in the area. HA 11 is more conducive to dispersal habitat for transient individuals. Harvest is low to nonexistent within Area 11.

Hunt Area 12: Increased harvest in Hunt Area 12 from 2010-2012 likely has moved from stabilization to reduction of the resident population.

Hunt Area 13: Relatively low harvest and connectivity to the Uinta Mountains of Utah indicative of stable population status.

Table A4. Mountain lion annual mortality data for the Southwestern MLMU, Harvest Years 2010-2012.

Hunt Area/ HY 2010	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA11	0	1	1	0	2	2	4	2
HA12	0	1	1	3	5	4	9	6
HA13	1	1	1	1	4	0	4	5
2010 Total	1	3	3	4	11	6	17	13

Hunt Area/ HY 2011	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA11	0	0	0	0	0	0	0	2
HA12	0	2	3	1	6	1	7	6
HA13	1	1	0	2	4	0	4	5
2011 Total	1	3	3	3	10	1	11	13

Hunt Area/ HY 2012	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA11	1	0	0	0	1	0	1	2
HA12	0	3	4	0	7	1	8	6
HA13	0	0	1	1	2	0	2	5
2012 Total	1	3	5	1	10	1	11	13
3 Year Sum	3	9	11	8	31	8	39	39
3 Year Mean	1.0	3.0	3.7	2.7	10.3	2.7	13.0	13.0

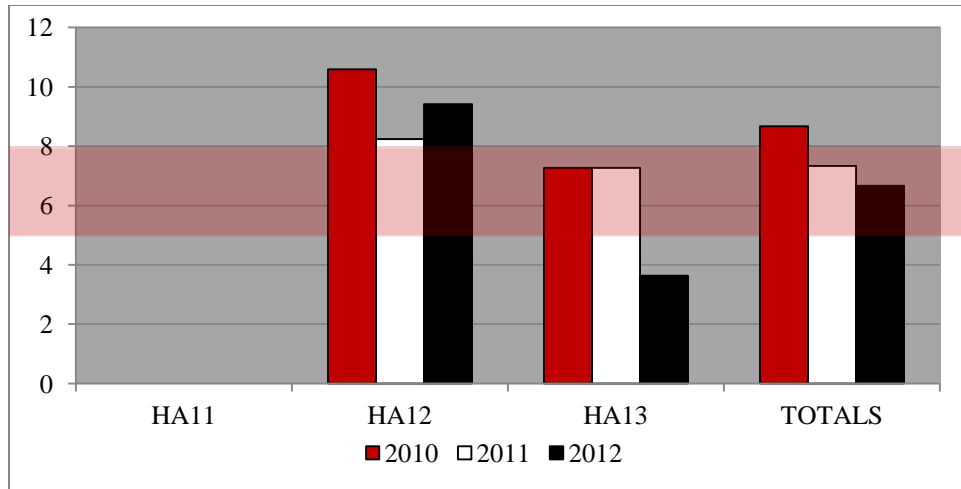


Figure A9. Total density of mountain lion mortality calculated from an annual summary of all human-caused mountain lion mortality per 1,000 km² of quantified mountain lion habitat, separated by Hunt Area and MLMU.

APPENDIX V. ABSAROKA DATA ANALYSIS UNIT

The Absaroka DAU consists of HAs 19 and 20 in Absaroka Mountains and foothills of Northwestern Wyoming. HA 19 is bordered on the west by Yellowstone National Park (YNP) and HA 20 is bordered on the south/southwest by the Wind River Reservation (WRIR). Both HAs contain a large amount of high quality mountain lion habitat ($> 7,000 \text{ km}^2$).

Hunt Area 19: Due to the high amount of quality mountain lion habitat and low density of lion mortalities, Area 19 is serving as a source, however maintaining levels of take as documented in 2012-2013 will likely serve to reduce the population through time (Increased female take, higher level of mortality).

Hunt Area 20: The high amount of preferential habitat and moderate levels of harvest suggest Area 20 is serving as a source population. Increased harvest may stabilize/reduce the population as seen through an increased amount of females harvested in the past two years.

Table A5. Annual mountain lion mortality data for the Absaroka Data Analysis unit of the Western MLMU, Harvest Years 2010-2012.

Hunt Area/ HY 2010	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA19	0	0	3	1	4	1	5	20
HA20	0	2	3	7	12	1	13	12
2010Total	0	2	6	8	16	2	18	32

Hunt Area/ HY 2011	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA19	0	1	4	2	7	2	9	20
HA20	0	6	5	1	12	0	12	12
2011 Total	0	7	9	3	19	2	21	32

Hunt Area/ HY 2012	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA19	3	1	13	3	20	1	21	20
HA20	3	3	4	3	13	2	15	12
2012 Total	6	4	17	6	33	3	36	32
3 Year Sum	6	13	32	17	68	7	75	96
3 Year Mean	2.0	4.3	10.7	5.7	22.7	2.3	25.0	32.0

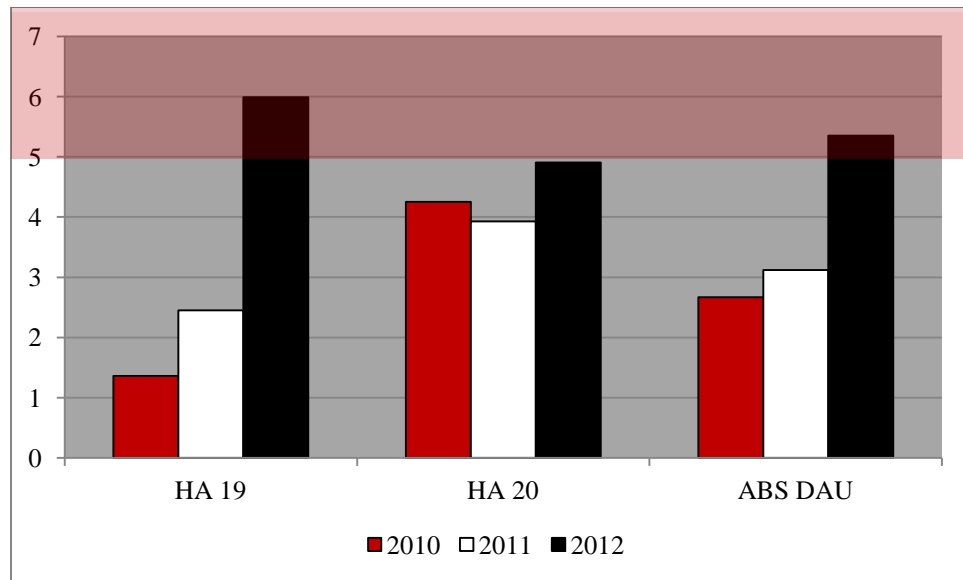


Figure A10. Total density of mountain lion mortality calculated from an annual summary of all human-caused mountain lion mortality per 1,000 km² of quantified mountain lion habitat, separated by Hunt Area and MLMU.

APPENDIX VI. WIND RIVER DATA ANALYSIS UNIT

The Wind River DAU of the Western MLMU consists of Hunt Areas 3, 4, 18, and 28. Hunt Area 28 is encompassed by the Wind River Reservation, with occasional harvest occurring on private inholdings within reservation boundaries that are monitored by the WGFD. Mountain lion harvest occurs sporadically on the reservation and mortality data acquired from tribal personnel and liaisons with the USFWS are used for analysis for the overall Hunt Area. The Wind River Mountain Range contains a great deal of mountain lion habitat, and harvest is parceled between HAs 3, 4 and 18.

Hunt Area 3: Low to moderate density of human caused mountain lion mortalities and moderate proportions of adult female lions harvested suggest HA 3 is functioning as a source area. Maintaining harvest at the mortality limit would likely stabilize and potentially reduce the population depending on level of female take.

Hunt Area 4. Increased harvest and mortality of mountain lions coupled with an increase of adult females in the annual harvest suggest the population is likely being stabilized and potentially reduced if harvest levels are maintained. Immigration is likely occurring from the Wind River Reservation (HA 28).

Hunt Area 18. Low/moderate density of mountain lion mortality is indicative of a source population, sustaining harvest levels such as incurred during HY 2012 would likely stabilize the resident population at a lower density.

Hunt Area 28. Due to a relative lack of harvest HA 28 is a source population and likely provides immigrants to other regions of the Wind River Range, Owl Creek, and Absaroka Mountains.

Table A6. Mountain lion annual mortality data for the Wind River Data Analysis Unit of the Western MLMU, Harvest Years 2010-2012.

Hunt Area/ HY 2010	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA 3	1	4	4	1	10	0	10	12
HA 4	1	2	4	1	8	1	9	8
HA 18	1	1	2	1	5	0	5	12
HA 28	0	0	1	0	1	0	1	3
2010 Total	3	7	11	3	24	1	25	35

Hunt Area/ HY 2011	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA 3	1	1	4	2	8	1	9	12
HA 4	2	2	2	1	7	3	10	8
HA 18	0	0	1	1	2	0	2	12
HA 28	0	0	2	0	2	0	2	3
2011 Total	3	3	9	4	19	4	23	35

Hunt Area/ HY 2012	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA 3	2	3	3	2	10	1	11	12
HA 4	3	2	3	0	8	0	8	8
HA 18	3	1	1	2	7	0	7	12
HA 28	0	0	0	1	1	0	1	3
2012 Total	8	6	7	5	26	1	27	35
3 Year Sum	14	16	27	12	69	6	75	105
3 Year Mean	4.7	5.3	9.0	4.0	23.0	2.0	25.0	35.0

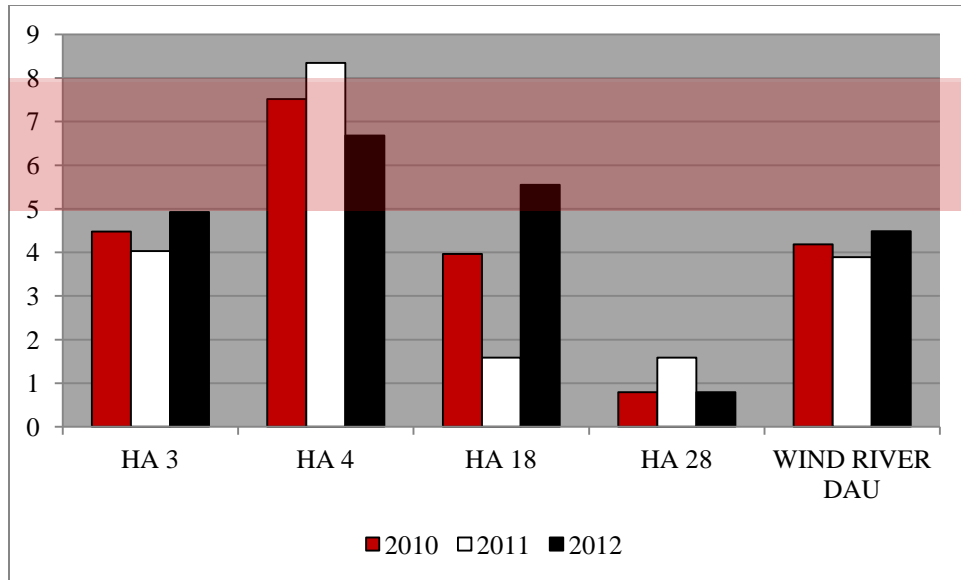


Figure A11. Total density of mountain lion mortality calculated from an annual summary of all human-caused mountain lion mortality per 1,000 km² of quantified mountain lion habitat, separated by Hunt Area and MLMU.

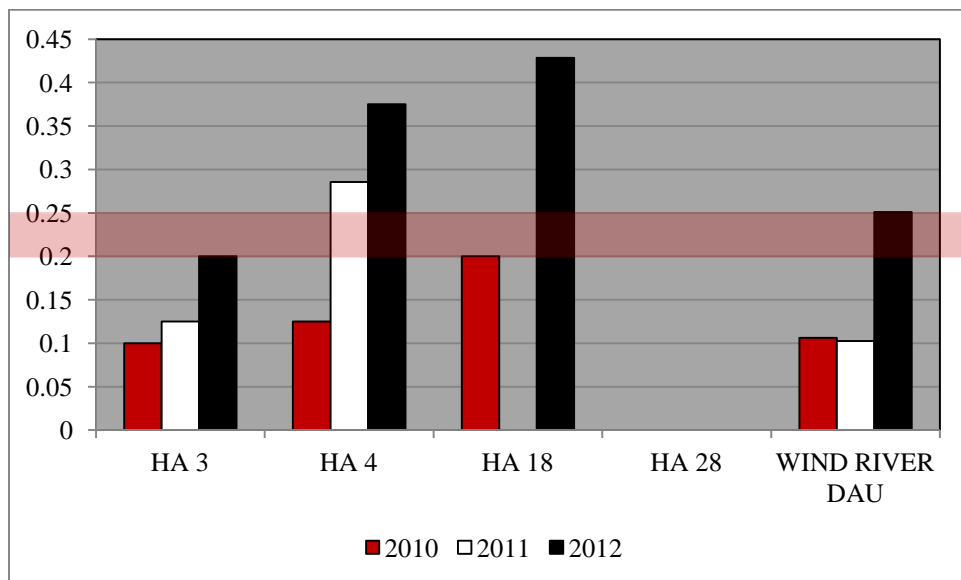


Figure A12. Proportion of adult females harvested annually separated by Hunt Area and MLMU. Age class for female mountain lions is determined by lactation status.

APPENDIX VII. WYOMING RANGE DATA ANALYSIS UNIT

The Wyoming Range DAU of the Western MLMU consists of Hunt Areas 2, 14, 17, 26, and 29. Hunt Area 2 contains Grand Teton National Park as well as the National Elk Refuge. Hunt Areas 14, 17 and 26 encompass the Wyoming Range Mountains of western Wyoming. The Wyoming Range DAU has a great deal of preferential winter lion habitat (approximately 9,200 km²).

Hunt Area 2: Low levels of human-induced mortality throughout Area 2 suggest the area is serving as a population source. Based on current research (Elbroch et al. in press) local mountain lion population abundance has decreased likely to a shift in distribution and is represented in low mortality limits for HA 2.

Hunt Area 14: Harvest management has likely moved toward stabilization of mountain lions in Area 14 (stable/sink), based on density of mountain lion mortalities and proportion of adult females harvested annually.

Hunt Area 17: Low mountain lion harvest annually suggest HA 17 functions as a source. However, due to winter range habitat manipulations with the region and resultant reductions in prey, biologically the front range may not be serving as a source population to other regions.

Hunt Area 26: Moderate levels of annual mortality and proportion of adult females harvested suggest stabilization of resident population in the Star Valley.

Hunt Area 29: The density of mountain lion mortality and proportion of females in the harvest indicate population stabilization in HA 29, with likely emigration still occurring among other Wyoming Range Hunt Areas.

Table A7. Mountain lion annual mortality data for the Wyoming Range Data Analysis Unit of the Western MLMU, Harvest Years 2010-2012.

Hunt Area/ HY 2010	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA2	0	0	1	0	1	1	2	5
HA14	2	5	4	4	15	2	17	15
HA17	0	0	0	1	1	0	1	9
HA26	2	4	2	3	11	0	11	15
HA29	2	1	1	2	6	2	8	6
2010 Total	6	10	8	10	34	5	39	50

Hunt Area/ HY 2011	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA2	0	0	0	0	0	1	1	5
HA14	3	6	4	2	15	0	15	15
HA17	0	0	0	0	0	0	0	9
HA26	1	0	3	1	5	0	5	15
HA29	0	2	1	1	4	2	6	6
2011 Total	4	8	8	4	24	3	27	50

Hunt Area/ HY 2012	Adult Females	Subadult Females	Adult Males	Subadult Males	Total Harvest	Non-Harvest Mortality	Total Mortality	Mortality Limit
HA2	1	2	0	1	4	0	4	5
HA14	2	0	4	3	9	1	10	15
HA17	0	2	2	1	5	0	5	9
HA26	1	1	6	2	10	0	10	15
HA29	2	2	1	1	6	1	7	6
2012 Total	6	7	13	8	34	2	36	50
3 Year Sum	16	25	29	22	92	8	102	150
3 Year Mean	5.3	8.3	9.7	7.3	30.7	2.7	34.0	50.0

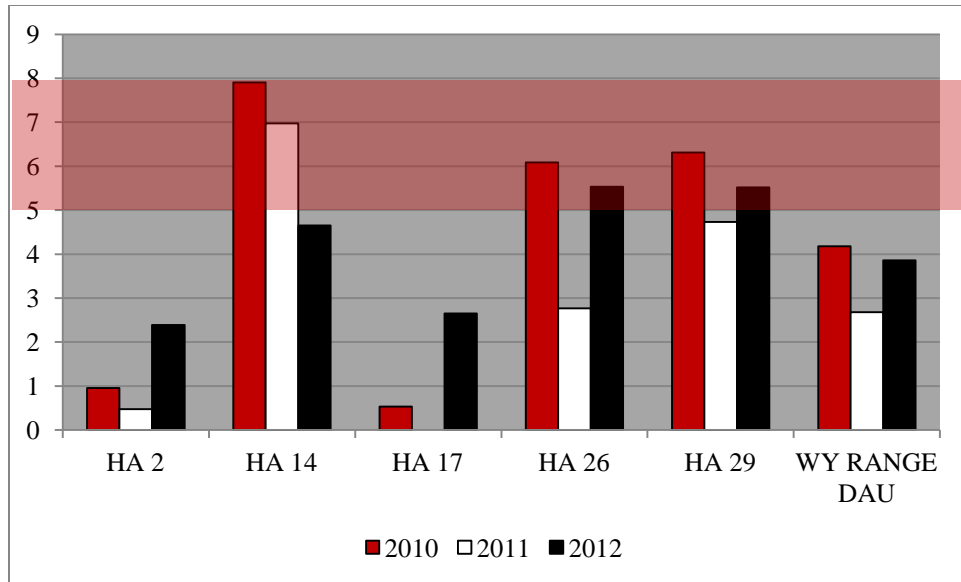


Figure A13. Total density of mountain lion mortality calculated from an annual summary of all human-caused mountain lion mortality per 1,000 km² of quantified mountain lion habitat, separated by Hunt Area and MLMU.

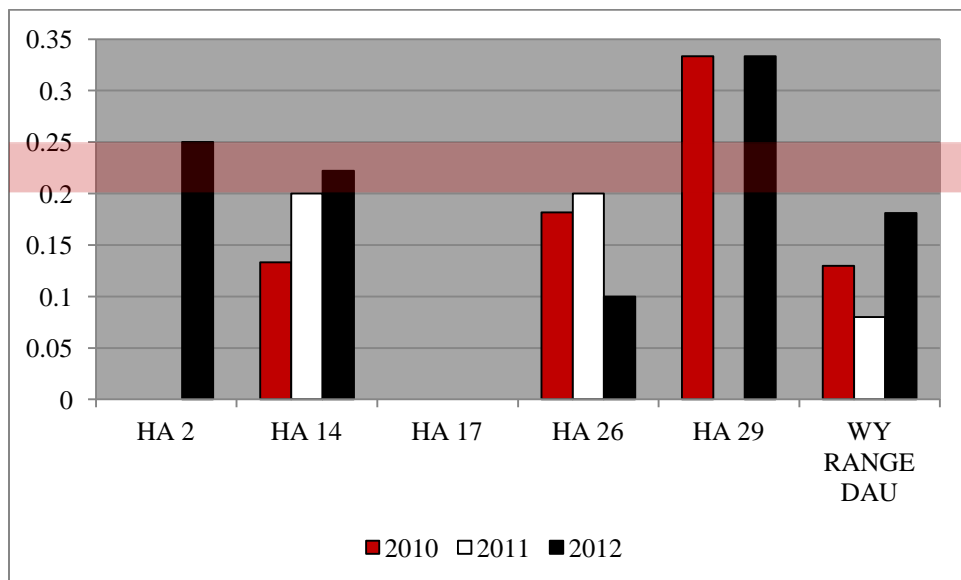


Figure A14. Proportion of adult females harvested annually separated by Hunt Area and MLMU. Age class for female mountain lions is determined by lactation status.